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ABSTRACT

In this investigation, students examine the topographic characteristics, water quality and human developments along Ohio's Olentangy River. They then learn about the Ohio Scenic Rivers Act and attempt to classify the Olentangy in accordance with this legislation. Presented are both a students' guide and a teacher's guide. The latter includes an overview of the unit, a materials list, teaching suggestions, answers to discussion questions and eight evaluation items. These activities can be modified to deal with almost any river in Ohio. (Author/WB)

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Ohio Sea Grant

OEAGLS - Oceanic Education Activities for Great Lakes Schools

HOW TO PROTECT A RIVER

by

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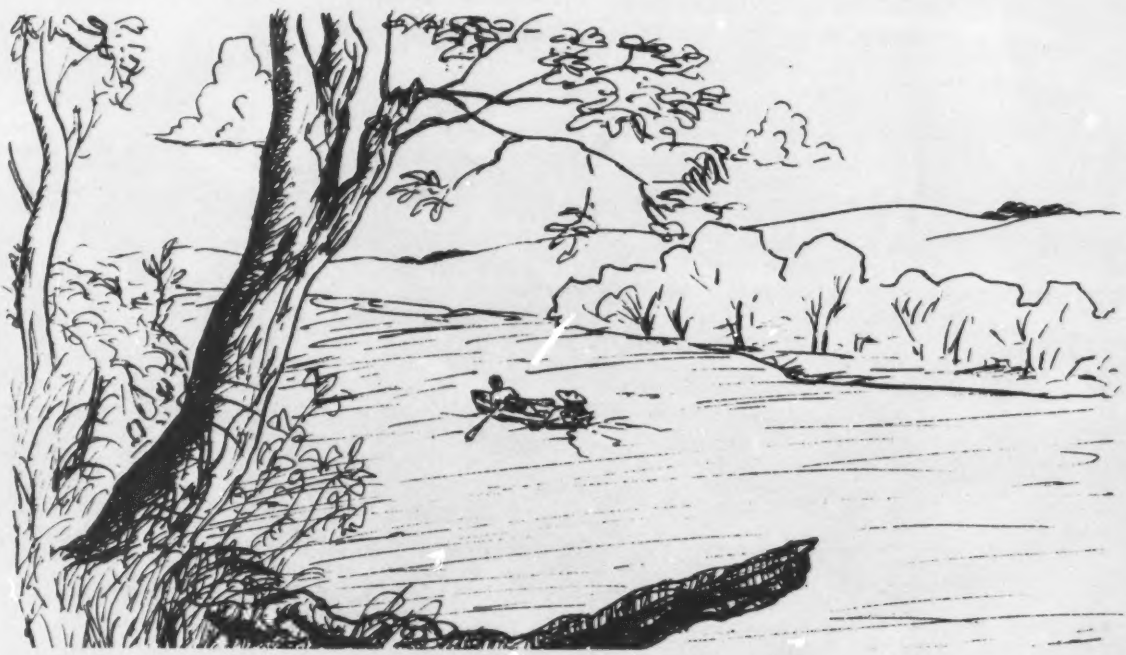

Ohio Sea Grant Program
Charles E. Herdendorf, Program Director
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SE 035 140

OEAGLS INVESTIGATION #4

Completed July, 1980

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HOW TO PROTECT A RIVER

INTRODUCTION

Rivers that were the lifeblood of our early cities and farm communities have suffered heavily because of man's use and misuse. Many have been dammed, dredged, channelized or otherwise changed. As a result, the scenic qualities of many of our streams have been destroyed.

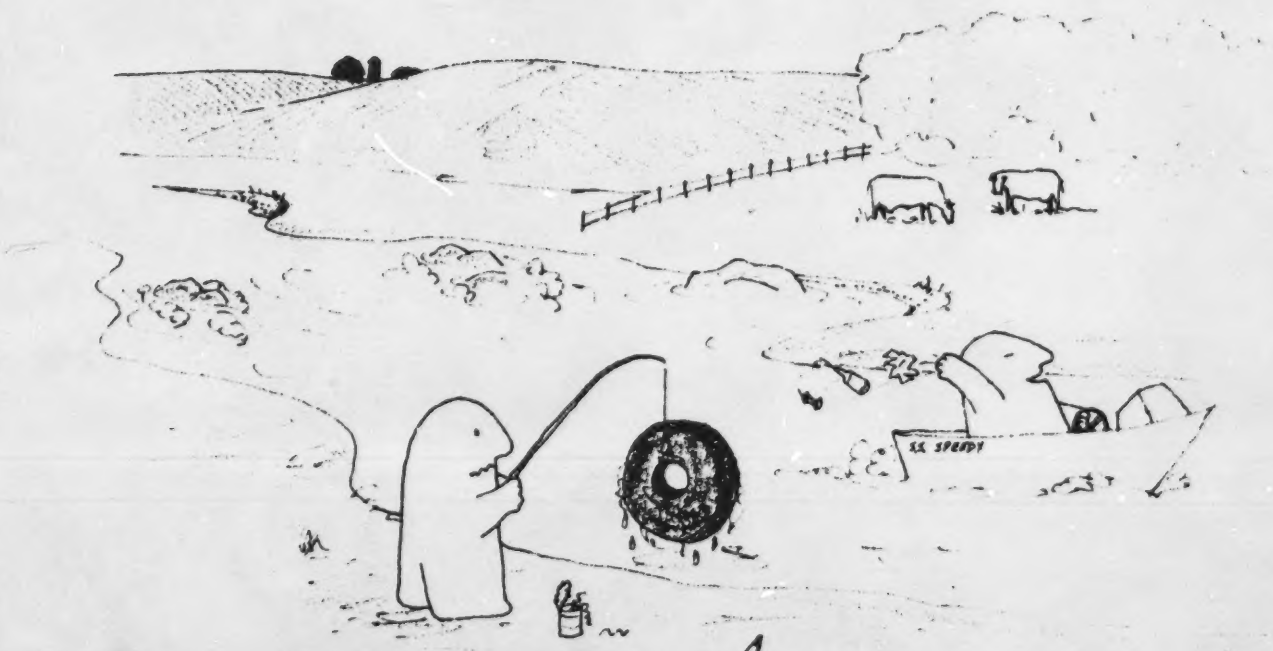
Concern for protecting the few high quality streams we have remaining in the State brought about the passage of Ohio's Scenic Rivers Act on February 28, 1968, by the 107th General Assembly. On May 17, 1972, Amended Senate Bill 108 was passed, which added wild and recreational rivers to the earlier act.

The goal of Ohio's Scenic Rivers Act is to identify the state's remaining high quality streams and to protect them from uses that would destroy their beauty and their historical, biological and recreational values.

OBJECTIVES

When you have completed this investigation you should be able to:

1. Describe some physical characteristics of the Olentangy River and its watershed.
2. Describe the water quality in the Olentangy River.
3. Identify some sources of pollution for rivers.
4. Discuss the difficulties of managing a natural river system in order to achieve and maintain the status of a "protected river."



ACTIVITY A

WHAT ARE SOME OF THE CHARACTERISTICS OF THE OLENTANGY RIVER?

MATERIALS

Principal Streams and Drainage Areas map; topographic maps of Delaware, Powell and Northwest Columbus; ruler; string.

PROCEDURES

1. Tell what you know about the Olentangy River.

_____

_____

_____

_____

Locate the Olentangy River on the map entitled Principal Streams and Drainage Areas.

2. Where is the source of the Olentangy?

_____

3. Where is its mouth?

_____

4. How many streams enter into the Olentangy along its length?

_____

These are its tributaries. Name the major ones.

_____

_____

5. Describe the topography along the river and its tributaries.

_____

_____

_____

You have been examining the watershed of the Olentangy River. The watershed of a river is the entire region where the river and its tributaries collect water.

6. Determine the area of the watershed of the Olentangy River. It's the area that lies between the two dotted lines on either side of the river. Estimate the average width of the watershed, and then the average length. Multiply the two distances to get the area.

   Average width _____

   Average length _____

   Area = length x width _____ square miles

7. From the map find another term for watershed.

   _____

8. Determine the length of the Olentangy River. One way to do this is by using a string. Hold one end of the string at the source. Then carefully cover the river with the string, being certain to follow each curve. Keep the end on the source. When you have reached the mouth of the river, mark that point on the string. Lay the string along the scale of the map to determine the length of the river in miles.

   _____

To answer the remainder of the questions, use the topographic maps.

9. What is the elevation of the contour line which crosses the Olentangy just south of the gaging station below the Delaware Dam?

   _____

10. What is the elevation of the contour line which crosses the Olentangy at the sewage disposal plant north of U.S. Interstate 270?

    _____

11. How many miles of river lie between these two locations?

    _____

12. Determine the gradient or average rate of drop of this section of the Olentangy.

$$\text{Stream Gradient} = \frac{\text{Difference of elevation between two points (ft.)}}{\text{Distance between two points (miles)}}$$

In Table 1 are water quality records from three places on the Olentangy. In the fourth column are the official water quality standards. The first number under each station is the reading taken in the spring when melting snow and rain cause high water and rapid flow. The second is the summer reading when the river has relatively low flow.

13. The three stations are Worthington, Delaware, and Claridon. Locate Worthington and Delaware on the Principle Streams and Drainage Areas map. About how far apart are they?

_____

Claridon is about 18 miles north of Delaware.

	Claridon		Delaware		Worthington		U.S.
	Spring	Summer	Spring	Summer	Spring	Summer	Standards
Sulfate	76	29	67	65	56	100	250
Chloride	29	34	43	37	33	59	250
Fluoride	0.2	0.3	0.1	0.2	0.2	0.4	1.0
Solids	294	423	308	303	234	410	500
Nitrate	3.9	0.5	4.8	3.5	3.6	0.8	10
Ammonia-Nitrogen	0.30	0.07	0.21	0.08	0.38	0.16	0.5
Arsenic	0	3	2	3	2	3	50
Chromium	30	10	10	6	30	10	50
Iron	80	30	20	60	60	50	300
Lead	2	2	7	11	11	4	50
Mercury	0	0	0	0	0	0.7	50

Table 1: 1977 Water quality values at three gaging stations on the Olentangy River and standards given in milligrams per liter.

14. What is meant by water quality?

_____

15. Are there any differences in water quality between the stations?

_____

If so, what could cause them? _____

_____

16. Are there differences between spring and summer records?

_____

What could cause these?

_____

_____

17. What might be the source(s) of these materials in the water?

_____

_____

18. List the materials found in the Olentangy that are in concentrations close to the U.S. water quality standards for those materials.

_____

_____

19. What can be done to correct these possible problems of water quality?

_____

_____

ACTIVITY B

HOW DOES A RIVER QUALIFY AS A "SCENIC RIVER?"

The Ohio Scenic Rivers Act classifies three types of rivers.

1. A wild river is essentially in its natural condition, with little evidence of human influence along its banks. The river is free-flowing, with no industries along it. The water quality is excellent.

2. A scenic river is also free-flowing, with just a little evidence of people, such as occasional homes, villages and bridges--visible from the river.

3. A recreational river is readily accessible by road for recreational use. It has more urban or industrial development along its banks. It is not necessarily free-flowing.

The stream's length, nearby forest cover, animal and plant life, water quality, amount of development, present use, ease of access and recreational values are all studied by the Ohio Department of Natural Resources. Then the river is listed as one of the above types and work can begin to protect and preserve it.

MATERIALS

Topographic maps of Delaware and Powell, Ohio; Ohio's Natural Streams Scenic Rivers Program pamphlet.

PROCEDURE

Examine the topographic maps for the Olentangy River from the Delaware Reservoir south to Mount Air.

1. Is this section of the river free-flowing?

   _____

   How do you know?

   _____

   _____

2. Is there any industrial development along this section?

   _____

   If so, where?

   _____

   _____

3. What evidence of urban and industrial development is visible from the river?

_____

_____

4. What types of agricultural uses are there?

_____

_____

5. What areas are set aside for recreational use?

_____

_____

6. Using information from Activity A, classify the water quality of the Olentangy as excellent, good, fair or poor.

_____

_____

_____

7. Which category of the Scenic Rivers Act best describes this section of the Olentangy River?

_____

_____

The Ohio Scenic Rivers Act states that once a river has been studied and qualifies under the wild, scenic or recreational categories, a coordinated program of stream preservation can begin. This requires the development of a corridor plan that will assure long-term protection for the river and the area extending 300 feet away from either shore.

A ten member citizens' advisory council must be appointed to guide the planning and implementation of the corridor plan. Imagine that you have been appointed a member of this advisory council. Your first task is to identify the specific goals and objectives for preserving the river. Read the pamphlet Ohio's Natural Streams Scenic River's Program to obtain more information for your task.

8. What needs to be done to protect this section of the Olentangy River?

_____

_____

9. What present uses of the land and river are acceptable? Defend your position.

_____

_____

10. What uses of the land and river should be stopped--or prevented in the future?

_____

_____

11. What could be done to improve the scenic nature of the river?

_____

_____

_____

REVIEW QUESTIONS

1. Describe the physical characteristics of the Olentangy River as completely as possible. Include its source and mouth, and its slope or gradient in the area studied.

_____

_____

_____

2. Re-examine Table 1. Determine whether the Olentangy is dangerously polluted or generally has good water quality. Defend your answer.

_____

_____

_____

3. Discuss the pros and cons of having this section of the Olentangy declared a scenic river. Include possible needs for new housing development, factories, recreation facilities, transportation routes and commercial development.

_____

_____

_____

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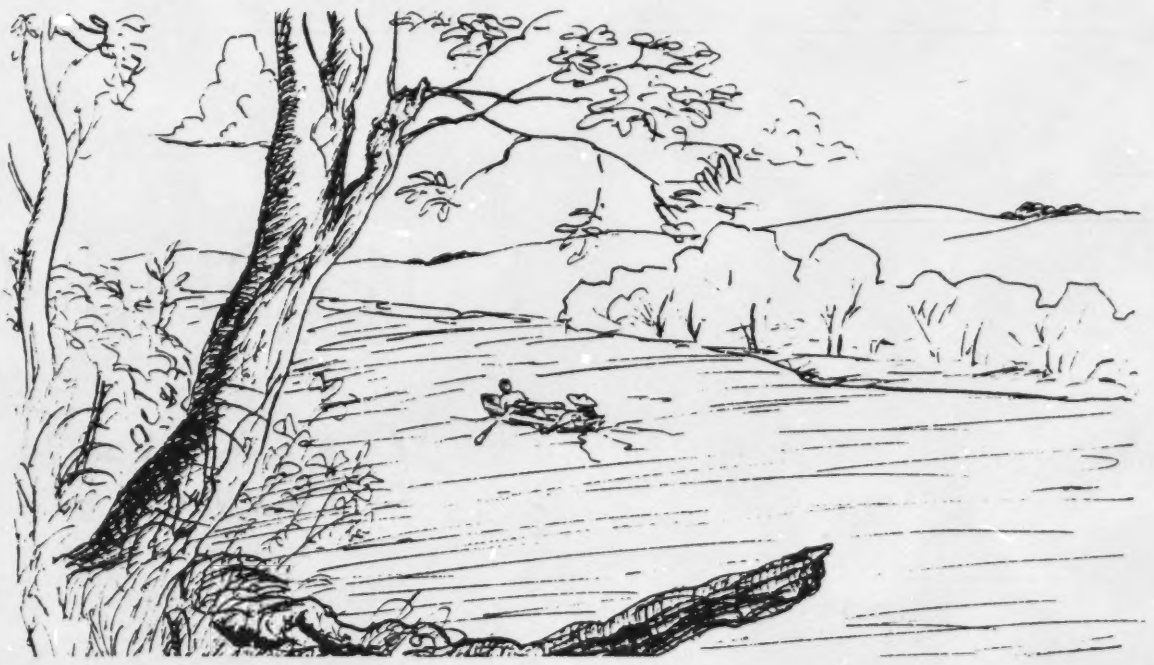

Ohio Sea Grant Program
Charles E. Herdendorf, Program Director
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TEACHER GUIDE

OEAGLS INVESTIGATION # 4
Completed May, 1980

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OVERVIEW

This is an investigation which can be modified to deal with most any river in Ohio (See Suggested Approach). In the investigation as written, students examine the Olentangy River, its water quality and the development that has occurred along one segment of it. They then learn about the Ohio Scenic Rivers Act and attempt to classify the Olentangy in accordance with this legislation. Students use topographic maps and a brochure published by the Ohio Department of Natural Resources in conducting this investigation.

PREREQUISITE STUDENT BACKGROUND

Students must be able to read a topographic map and to use scale in determining the distances between points on a map. They should also be somewhat familiar with the river that is the subject of the investigation.

MATERIALS

For each group of two students you will need the following:

1. A Principal Streams and Drainage Areas map (1973) for Ohio;
2. Topographic maps of Delaware, Powell and Northwest Columbus;
3. The brochure entitled Ohio's Natural Streams: The Scenic Rivers Program.

All of the above are available from the Ohio Department of Natural Resources, Fountain Square, Columbus, OH 43224. There is a charge for the maps. In addition, students will need string and a ruler.

OBJECTIVES

When the students have completed this investigation, they should be able to:

1. Describe some physical characteristics of the Olentangy River.
2. Describe the water quality in the Olentangy River.
3. Identify some sources of pollution for rivers.
4. Discuss the difficulties of managing a natural river system in order to achieve and maintain the status of a "protected river."

SUGGESTED APPROACH

Both activities can be done by individual students. If not enough materials are available, then they are best done in groups of no more than two students.

This particular investigation should be considered a model for one that can be modified by teachers using rivers in their own areas of the state. To do this you would have to identify the topographic sheets that cover a stretch of your local river and obtain them from the Department of Natural Resources. In addition, you would need to obtain a copy of the publication entitled, Water Resources Data for Ohio, Water Year (current). This is available from the Division of Water Resources, United States Geological Survey, 975 W. 3rd Street, Columbus, OH 43212. From this publication you can identify stations along your river of choice where the USGS has collected water quality data. You would then develop a Table to replace Table 1 using the data from your river. The questions in each activity should be applicable for any river, if different locations are inserted in place of those located on the Olentangy.

ACTIVITY A

WHAT ARE SOME OF THE CHARACTERISTICS OF THE OLENTANGY RIVER?

The purpose of this activity is for students to recall and learn information about the topography, water quality and development along the Olentangy River.

PROCEDURE

The intent of the first question is for students to be able to record their knowledge and impressions of the river before they begin to learn some specific things about it. Therefore, they are not expected to know any detailed information.

1. Any student responses should be accepted. It is hoped that students would record their feelings about the river as well as any knowledge they may have of it.

After students have completed the first question, conduct a class discussion. Have students share their information and feelings about the river with the class as a whole. This will help to get the class interested in the investigation, and can also provide some information for students to use on certain of the questions that follow.

2. The Olentangy arises in the Northern part of Morrow County, and runs through the city of Galion.

3. It empties into the Scioto River in the city of Columbus.

4. Students will be able to count about 12 tributaries. The ones that are named on the Principle Streams map are Muddy Run and Whetstone. If students also refer to the Powell and Northwest Columbus topographic maps they can identify the Delaware River and Adena Brook as major tributaries in the Columbus area.

5. The Olentangy in general flows through flat terrain, a till plain formed by the glacier. It has cut down through the till plain so that in the vicinity of the river and its tributaries there is often a fair amount of relief as the floodplain of the river is approached. The floodplain varies in width, but provides a relatively flat area of land adjacent to the river.

In answering question 5, students will not be able to get information on topography from the Principle Streams map. Much of this information they should already know based on their experiences with the river and the class discussion held after completing question 1. If not, you may want to conduct a class discussion using slides and visuals, illustrating typical topography associated with the river, before students complete question 5.

6. The answer to this will vary depending upon the value estimated for the average length and width. It should be approximately 400 to 500 square miles.

7. From the name of the map students should conclude that drainage area is synonymous with watershed.

8. The river is about 75 miles long.

9. The elevation is 880 feet.

10. Here the elevation is 750 feet.

11. These locations are about 20.5 miles apart.

12. Substituting into the formula

$$\frac{880 \text{ ft.} - 750 \text{ ft.}}{20.5 \text{ mi}} = \frac{130 \text{ ft.}}{20.5 \text{ mi}} = 6.34 \text{ ft/mi}$$

13. Delaware is about 14 miles north of Worthington. Students should see that the samples are from widely spaced locations.

14. You may need to discuss the meaning of water quality with your students. In essence it is a measure of the dissolved materials in water. Some, such as oxygen, are good in that they are necessary for the support of life. Relatively high amounts indicate good water quality. Others may be detrimental either to life or to the asthetic aspects of streams. All of the constituents listed in Table 1, if high, would be detrimental to water quality.

15. Nitrates are relatively high at Delaware. These are components of animal waste and might be expected to be found downstream from agricultural areas and from sewage disposal sites. Ammonia-Nitrogen is a component of fertilizers and may come from agricultural areas. Chloride is relatively high at Worthington.

16. In some cases. This may be due to seasonal variations in sources of pollution. Also, during the spring runoff is much higher than during summer. Therefore, pollutants are diluted during the spring and provide readings of lower concentration than during the summer. The total solids data illustrate this.

17. Sources include industrial and agricultural pollution, dissolved bedrock, sediments eroded from soil and bedrock, and wastes of biological processes.

18. Ammonia-Nitrogen is high in the Worthington spring reading. Total solids are also high in all readings.

19. Ammonia-Nitrogen and the solids are the materials that come closest to U.S. standards. A major source for both are agricultural practices. Working through county extension agents, farmers must be made aware of these pollution problems and acquainted with practices they can use to control soil erosion and the leaching of fertilizers into the river. Effective measures would also be of benefit to them, saving money on fertilizers and preserving their soil. Another source of solids would be construction sites where larger areas of soil might be exposed. Construction companies should be alerted to the problems that their current practices cause and helped to change construction practices. The restriction of construction in the vincinity of the river would also keep these problems from becoming too severe.

You should spend some time discussing with students what could be done to lessen pollution. Get their ideas. Bring in some background information. The Ohio EPA can provide some information on your local area.

ACTIVITY B

HOW DOES A RIVER QUALIFY AS A "SCENIC RIVER?"

PROCEDURE

This activity is designed to acquaint students with Ohio's Scenic Rivers Act.

Keyword: Free-flowing. A stretch of river that is not impeded by dams.

1. This section of the river is free-flowing since there are no dams.

2. It is not apparent from maps whether there is industrial development along the river. Rely on your students' knowledge of the area. Also, you might want to obtain a phone book for Delaware. Students can use it to identify industries that might be along the river.

3. Although it is difficult to tell from a map, there would appear to be considerable development along the river in the vicinity of Delaware. On the Powell map, however, there is relatively little development indicated. Students will be able to identify railroad and highway bridges, private residences, a gravel pit or quarry, churches, cemetaries, the gaging stations, sewage disposal plants and protected stream banks.

4. To answer this question, you will have to relv on the students' knowledge of the area. A variety of crops are raised. There may be dairy farms and feeding lots. Several orchards are indicated on the map.

5. Again you will have to rely on student information. There is a city park and a metropolitan park (Highbanks), a number of commercial recreational facilities like Olentangy Caverns, a swimming pool, a golf course and a drive-in theater.

6. In general, the water quality of the Olentangy is good. None of the standards are exceeded.

7. Students should conclude after reading the pamphlet and examining the river that it qualifies as a "scenic river."

8. Long-range planning must be done to protect the river. Protection comes from the encouragement of low-impact uses, such as parks and other recreational uses. High-impact uses, such as industrial, must be excluded. Sewage treatment and industrial waste treatment must be strictly enforced for industry, villages and towns, and agricultural uses that already exist.

9. Allow students to arrive at their own conclusions, based on their work on this investigation.

10. Again, allow students to arrive at conclusions. Possibilities are: 1) Monitor sewage disposal; 2) Curtail future highway construction on banks of the river; 3) Restrict agricultural chemicals used near the river to low-impact types; 4) Curtail channelization and filling along stream banks; 5) Curtail housing projects along stream banks.

11. Again get students' ideas. Possibilities are the reintroduction of native plant species, the removal of abandoned structures, and the filling in or leveling of gravel pits, quarries and foundations.

REVIEW QUESTIONS

1. The Olentangy arises in Morrow County, Ohio, on a till plain. It flows south across the till plain, and empties into the Scioto River at Columbus. The total length of the Olentangy is about 60 miles. The average gradient between Delaware Lake Dam and Columbus is about 7.8 ft/mile.

2. All measurements are below established water quality standards, so the Olentangy generally has good water quality.

3. Successful protection depends in part upon effectiveness of ten-member citizens's advisory councils.

Cons

In general, protection would hinder any kind of capital development which may be needed by the ever increasing population of the area. Recreational facilities will attract people to the area and require increased development of services. This would also require sewage disposal facilities, but not on the scale required by industrial or residential development.

Pros

Water quality will be preserved for high quality use in the future. The preservation of scenic aspects of the area and of vegetation and wildlife will provide more desirable recreation facilities.

EVALUATION ITEMS

1. The area from which a river collects its water is called a

   1. gradient.
   *2. watershed.
   3. flood plain.
   4. river basin.

2. The Ohio River and the Missouri River drain into the Mississippi River. What term is used to describe a stream or river which flows into a larger river?

   1. Canal
   2. Reservoir
   3. Offshoot
   *4. Tributary

3. Relatively high amounts of which element below will enhance the water quality of a river?

   *1. Oxygen
   2. Nitrate
   3. Arsenic
   4. Chloride

4. In the last few years, the concentration of pollutants in the Olentangy River has been higher in Summer than in Spring. All of the following statements can explain this fact except which one?

   1. There is higher water runoff from land in Spring than in Summer.
   *2. The pollutants are filtered out of the river every Spring.
   3. The sources of pollutants vary among the seasons.
   4. The pollutants are diluted in Spring by melting ice.

5. A river that has no industries along its banks, is free-flowing and has excellent water quality can qualify as a

   1. pleasure river.
   2. scenic river.
   *3. wild river.
   4. recreational river.

6. Which of the following categories fits the Olentangy River?

   1. industrial river
   2. recreational river
   *3. scenic river
   4. wild river

7. The purpose of the Scenic Rivers Act is to

   1. develop rivers for sewage disposal.
   *2. protect Ohio rivers.
   3. create recreational areas along most Ohio rivers.
   4. develop rivers as water sources.

8. A major source of pollution on the Olentangy is

   1. trees along the banks.
   2. recreation areas.
   3. steel mills.
   *4. farming.